Claims

1. A piezoelectric sensor arrangement for analysis of fluid samples, which includes a signal source, a measuring device and a docking system, which arrangement comprises a first part (8) and a second part (11, 12), said second part (11, 12) comprising fluid channels (13) for the sample and said first and second part being movable in relation to each other between a closed position and an open position, wherein
said first part (8) is provided with means (9) for receiving a sensor element (10), which sensor element exposes a piezoelectric quartz crystal (32) having a freely accessible electrode(33), which is intended to come into contact with the fluid sample, which means (9) comprises an opening (17) through which the crystal of the sensor element can come into contact with a flow cell element (14) and that
said second part (11, 12) comprises fluid channels (13) for the sample and a flow cell element (14) that comprises an abutting part (43), which is provided with an outwardly open recess (45), and inlet and outlet fluid channels (46) for leading a fluid through the recess, said recess (45) being surrounded by an abutting surface (48), and wherein at least said abutting surface and the portion of the abutting part (43) closest to the abutting surface is made of an elastic material, which is capable of sealing against the piezoelectric quartz crystal,
said first and second parts (8, 11, 12) being arranged such that when the first and second parts (8; 11,12) are moved from the open position to the closed position the upper surface (48) of the abutment part (43) of the flow cell element (14) comes into abutment with the exposed piezoelectric quartz crystal (32) of the sensor element (10) whereby in the closed position the piezoelectric quartz crystal (32) sealingly covers the recess (45) of the flow cell element (14) thus creating a flow cell.

2. A sensor arrangement according to claim 1, **characterised in** that the flow cell element (14) removable.

3. A sensor arrangement according to claim 1 or 2, **characterised in** that said elastic material has a hardness of 10 - 95° Shore.

4. A sensor arrangement according to claim 3, **characterised in** that said elastic material has a hardness of 45-95° Shore.

5. A sensor arrangement according to any one of claims 1-4, **characterised in** that the first part (8) is arranged to move slidably with relation to the second part (11, 12), so that the quartz crystal (32) comes into abutment with the flow cell element in the second part (11, 12).

6. A sensor arrangement according to any one of the preceding claims, **characterised in** that the first part (8) is guided between said closed and open positions by means of guide rods (28).

7. A sensor arrangement according to any one of the preceding claims, **characterised in** that the first part (8) is guided along a linear path.

8. A sensor arrangement according to any one of the preceding claims, **characterised in** that the means (9) for receiving the sensor element (10) has a cavity provided with a slot (16), through which the sensor element can be inserted and an opening (17) through which the crystal of the sensor element can come into contact with the flow cell element (14).

9. A sensor arrangement according to any one of the preceding claims, **characterised in** that the second part (11, 12) comprises an sample providing part (11) that has a recess in which the flow cell element (14) is arranged and an operating part (12) that includes means (23, 24) for movement of said first part (8).

10. A sensor arrangement according to claim 9, **characterised in** that the means (23, 24) for movement of said first part (8) includes a screw (23) which is connected by thread engagement to the first part (8) and which is operated by a handle (24).

11. A sensor arrangement according to any one of the preceding claims, **characterised in** that the second part is provided with electrical contacts (22) for connection with electrical contact areas on the sensor element.

12. A sensor arrangement according to claim 11, **characterised in** that the electrical contacts (22) are spring loaded contacting pins.

13. A sensor arrangement according to claim 11 or 12, **characterised in** that the electrical contacts (22) are arranged on the sample providing part (11).

14. A sensor arrangement according to any one of the preceding claims, **characterised in** that the recess (45) of the flow cell element has a shape that corresponds to the shape of the first electrode (33).

15. A sensor element for use in the piezoelectric sensor arrangement of claim 1, **characterised in** that it comprises a carrier (31) to which a piezoelectric quartz crystal (32) is attached, said crystal having a front side and a rear side,
where said front side is intended to come into contact with the fluid sample and is provided with a front electrode (33) and
said rear side is provided with a rear electrode (42), both electrodes being adapted to receive electric signals for generation of an oscillating motion of the crystal,
whereby the crystal is arranged on the carrier in such a manner that the front side of the crystal (32) and the front electrode (33) are freely accessible, and adapted to come into abutment with the flow cell element (14) of the piezoelectric sensor arrangement (4),
when the first (8) and second (11, 12) parts of the piezoelectric sensor arrangement (4) are moved from their open position to their closed position, whereby it sealingly covers the recess (45) of the flow cell element, thus forming a flow cell (50) together with the flow cell element.

16. A sensor element according to claim 15, **characterised in** that the electrodes (33, 42) are electrically connectable to external contacts (22).

17. A sensor element according to claim 15 or 16, **characterised in** that the piezoelectric crystal is arranged in the carrier such that the piezoelectric crystal is supported by the carrier from the rear side during abutment of the flow cell element.

18. A sensor element according to any one of claims 15-17, **characterised in** that the carrier has the shape of a plate, having a surface area of 1-100 cm^2, preferably 5-30 cm^2 and more preferably 10-20 cm^2.

19. A sensor element according to any one of claims 15-18, **characterised in** that the thickness of the carrier is 0,5-10 mm.

20. A sensor element according to any one of claims 15-19, **characterised in** that the surface area of each electrode (33, 42) is smaller than the surface area of the crystal (32), such that each side of the crystal comprises an area between the electrode edge and the crystal periphery that is not covered by electrode material and that each electrode has a connecting portion (33a, 42a) that extends towards the crystal periphery.

21. A sensor element according to any one of claims 15-20, **characterised in** that the carrier comprises a front part (34) and a rear part (35), between which the crystal (32) is attached, said front part being provided with an opening (36) for exposure of the crystal.

22. A sensor element according to any one of claims 15-21, **characterised in** that the carrier comprises a recess or opening in the area of the rear electrode (42), so as to avoid damping of the crystal.

23. A sensor element according to any one of claims 20-22, **characterised in** that electrical contacting means (40) are connected to the electrodes at the connecting portions (33a, 42a) of the electrodes.

24. A sensor element according to any one of claims 20-23, **characterised in** that externally accessible electrical contacting areas (37) are provided on the carrier, which areas are electrically connected to the contacting portions (33a, 42a) of the electrodes.

25. A sensor element according to claim 24, **characterised in** that the electrical contacting areas (37) are situated on the front part (34) of the carrier.

26. A sensor element according to any one of claims 20-25, **characterised in** that the connecting portion (42a) of the rear electrode (42) reaches the front side of the crystal, so that both electrodes are accessible from the front side of the crystal.

27. A sensor element according to any one of claims 20-25, **characterised in** that the carrier comprises an opening in the area of the rear electrode (42) and the connecting portion (33a) of the front electrode (33) reaches the rear side of the crystal, so that both electrodes are accessible from the rear side of the crystal.

28. A sensor element according to claim 26 or 27, **characterised in** that the connecting portions (33a, 42a) are accessible to external contacts.

29. A sensor element according to any one of claims 15-28, **characterised in** that the front electrode (33) is coated with an active substance for analysis of the sample.

30. A sensor element according to any one of claims 15-29, **characterised in** that a removable protecting foil is arranged so as to cover the crystal.

31. A sensor element according to claim 30, **characterised in** that the removable protecting foil is resealable.

32. A flow cell element (14) for use in the piezoelectric sensor arrangement of claim 1 **characterised in** that it comprises an abutting part (43), which is provided with an

outwardly open recess (45) and inlet and outlet fluid channels (46) by means of which a fluid sample can be lead through the recess,
said recess (45) being surrounded by an abutting surface (48), at least said abutting surface and the portion of the abutting part (43) closest to the abutting surface being made of an elastic material,
wherein said abutting part (43) is adapted to come into abutment with the piezoelectric quartz crystal (32) in the sensor element (10) of claim 11, when the first (8) and second (11, 12) parts of the piezoelectric sensor arrangement (4) are moved from their open position to their closed position, whereby the recess (45) is sealingly covered by the crystal, thus forming a flow cell (50) together with the sensor element (10).

33. A flow cell element according to claim 32, **characterised in** that said elastic material has a hardness of 10 - 95° Shore.

34. A flow cell element according to claim 33, **characterised in** that said elastic material has a hardness of 45-95° Shore.

35. A flow cell element according to any one of claims 32-34, **characterised in** that the abutting surface (48) that surrounds the recess (45) is constituted by a ridge (47), which has a smooth upper surface (48) and that the bottom of the recess is a flat surface.

36. A flow cell element according to claim 35, **characterised in** that the ridge (47) has a width of 0,05-1 mm.

37. A flow cell element according to any one of claims 32-36, **characterised in** that the recess has a depth of 0,01-05 mm, preferably 0,05-0,2 mm.

38. A flow cell element according to any one of claims 32-36, **characterised in** that the inlet and outlet fluid channels (46) are arranged close to the periphery of the recess and diametrically opposed to each other.

39. A flow cell element according to any one of claims 32-38, **characterised in** that the recess has extensions (52) in which the extensions the inlet and outlet fluid channels (46) are arranged.

40. A flow cell element according to any one of claims 32-39, **characterised in** that it is made in one piece.

41. A flow cell element according to any one of claims 32-40, **characterised in** that the elastic material is polyurethane, silicone or PDMS.

42. A method for forming a flow cell in which a sensor element (10) having a freely accessible piezoelectric quartz crystal (32) is brought into abutment with a flow cell element (14), which comprises an outwardly open recess (45) and inlet and outlet fluid channels (46) by means of which a fluid sample can be lead through the recess, said sensor element and said flow cell element being held together by a pressing force.